

WHAT IS CLAIMED IS:

1. An anastomotic stent for connecting one end of a graft vessel to a target vessel, comprising

5 a) a substantially cylindrical body having a longitudinal axis, an open proximal end, an open distal end, and a lumen extending therein configured to receive the graft vessel; and

10 b) at least one deformable section on the cylindrical body having a first configuration, and a radially expanded second configuration which forms a flange configured to apply an expanding force radial to the cylindrical body longitudinal axis against the wall of the target vessel.

2. The stent of claim 1 wherein the deformable section is on a distal section of the cylindrical body.

15 3. The stent of claim 2 wherein the deformable section is on a proximal section of the cylindrical body.

4. The stent of claim 2 further including a deformable section on the proximal end of the cylindrical body having a first configuration, and a radially expanded second configuration which forms a proximal end flange.

20 5. The stent of claim 1 wherein the deformable section comprises a plurality of helical members having proximal and distal ends, the helical

members being circumferentially spaced around the cylindrical body, so that the cylindrical body longitudinally collapses and the helical members radially expand from the first to the second configuration by circumferential rotation of the proximal end of the cylindrical body relative to the distal end of the 5 cylindrical body.

6. The stent of claim 1 wherein the stent is configured to secure one end of the graft vessel to a target vessel having a wall thickness of about 0.5 mm to about 5 mm.

7. The stent of claim 6 wherein the stent has a length substantially equal to the thickness of the target vessel wall when the deformable section 10 is in the second configuration.

8. The stent of claim 1 wherein the flange is from about 4 mm to about 10 mm in diameter.

9. The stent of claim 1 wherein the cylindrical body has a substantially uniform diameter when the deformable section is in said first 15 configuration.

10. An anastomotic stent for connecting one end of a graft vessel to a target vessel, comprising

10 a) a substantially cylindrical body having a longitudinal axis,

an open proximal end, an open distal end, and a lumen extending
therein configured to receive the graft vessel;

15 b) a deformable section located on the distal end of the

cylindrical body, having a first configuration, and a radially expanded
and longitudinally collapsed second configuration which forms a
flange; and

20 c) a deformable section located on the proximal end of the

cylindrical body, having a first configuration, and a radially expanded
and longitudinally collapsed second configuration which forms a
flange.

11. The stent of claim 10 wherein deformable sections comprises a
plurality of helical members having proximal and distal ends.

15 12. The stent of claim 11 including at least one deflecting section
on each helical member, and wherein the deflecting sections on the distal
helical members deflect at lower torque than the deflecting sections on the
proximal helical members, so that the distal flange forms before the proximal
flange by circumferential rotation of the proximal end of the cylindrical body
relative to the distal end of the cylindrical body.

20 13. The stent of claim 12 wherein the deflecting section comprises
at least one notch in the helical member, and wherein the size of the notches

on the distal helical members is greater than the size of the notches on the proximal helical members.

14. The stent of claim 13 wherein the notch is located substantially centrally along the length of the helical member between the proximal and distal ends of the helical member.

15. The stent of claim 13 wherein the notch is located distally or proximally of a central point along the length of the helical member, so that the flange has an angled configuration relative to the longitudinal axis of the stent.

10 16. An anastomosis assembly for connecting a graft vessel to a target vessel comprising,

15 a) an elongated stent delivery member comprising an outer tubular member having proximal and distal ends and a lumen therein, and an inner tubular member having proximal and distal ends and a lumen therein, rotatably disposed within the outer tubular member lumen; and

20 b) an anastomotic stent on a distal extremity of the elongated stent delivery member, comprising a substantially cylindrical body having an open proximal end, and open distal end, a lumen extending therein configured to receive the graft vessel, and at least one deformable section having a first configuration for introduction

into the target vessel and a second configuration which forms a flange.

17. The assembly of claim 16 including an elongated vessel penetrating member which is configured to extend through the lumens of the 5 inner tubular member, cylindrical body disposed thereon, and graft vessel disposed therein, and extend out the distal end of the cylindrical body, having a distal tip configured to penetrate through the wall of the target vessel, and an expandable distal member for positioning at least the distal end of the anastomotic stent within the target vessel.

10 18. An implanted anastomotic stent for connecting one end of a graft vessel to a target vessel, comprising

- a) a substantially cylindrical body having a longitudinal axis, an open proximal end, an open distal end, and a lumen extending therein configured to receive the graft vessel;
- 15 b) at least one deformable section on the cylindrical body having a flange applying an expanding force radial to the cylindrical body longitudinal axis against the wall of the target vessel; and
- c) a graft vessel secured to the stent and extending within the lumen of the cylindrical body.

20 19. A method of forming a vascular anastomosis between a graft vessel and a target vessel, comprising

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a) connecting an end of the graft vessel to an anastomotic
stent comprising

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a substantially cylindrical body having a longitudinal axis,
an open proximal end, an open distal end, and a lumen
extending therein configured to receive the graft vessel; and
at least one deformable section on the cylindrical body
having a first configuration, and a radially expanded second
configuration which forms a flange;

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b) introducing the stent into an incision in the target vessel;

and

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c) circumferentially rotating the distal end of the stent
relative to the proximal end of the stent so that the stent body
longitudinally collapses and the deformable section expands from the
first to the second configuration to form the flange.

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20. The method of claim 19 wherein the deformable section is on a
distal section of the cylindrical body and the step of connecting the first end
of the graft vessel to the stent comprises positioning the graft in the lumen
of the stent and everting the end of the graft out the distal end of the stent
and at least about at least the deformable section on the distal section of the
stent body.

21. The method of claim 20 wherein the graft vessel is everted about a section of the stent proximal to the deformable section on the distal section of the stent body.

22. The method of claim 19 wherein the stent further includes a 5 deformable section on a proximal section of the stent, and including, after the step of radially expanding the distal deformable section, the step of rotating the distal end of the stent relative to the proximal end of the stent, so that the stent body longitudinally collapses and the proximal deformable section expands from the first to the second configuration to form a proximal 10 end flange.

23. The method of claim 22 wherein the distal end of the stent is rotated relative to the proximal end of the stent so that the proximal end flange is in contact with the target vessel.

24. The method of claim 19 wherein the step of circumferentially 15 rotating the distal end of the stent relative to the proximal end of the stent comprises

a) positioning the stent on a distal extremity of an elongated stent delivery member comprising an outer tubular member having proximal and distal ends and a lumen therein, and an inner tubular 20 member having proximal and distal ends and a lumen therein rotatably disposed within the outer tubular member lumen, so that the distal end

of the stent is releasably connected to the inner tubular member and the proximal end of the stent is releasably connected to the outer tubular member; and

5 b) rotating the inner tubular member relative to the outer tubular member to thereby circumferentially rotate the distal end of the stent relative to the proximal end of the stent.

25. The method of claim 19 wherein the step of introducing the stent into the target vessel comprises

10 a) disposing within the lumen of the anastomotic stent and graft vessel disposed therein an elongated vessel penetrating member having a shaft, a distal tip, and at least one expandable member on a distal section;

15 b) advancing the distal tip through the wall of the target vessel and into the target vessel lumen, to form an incision therein; and

c) expanding the expandable member to increase the width of the incision in the target vessel.

26. The method of claim 25 wherein the elongated vessel penetrating member further includes a second expandable member, and 20 including the step of expanding a second expandable member to draw the penetrating member and stent thereon into the incision in the target vessel.

27. The method of claim 25 including before step (a) the steps of

- a) positioning the stent on a distal extremity of an elongated stent delivery member comprising an outer tubular member having proximal and distal ends and a lumen therein, and an inner tubular member having proximal and distal ends and a lumen therein rotatably disposed within the outer tubular member lumen, so that the distal end of the stent is releasably connected to the inner tubular member and the proximal end of the stent is releasably connected to the outer tubular member; and

b) positioning the elongated vessel penetrating member within the lumen of the elongated stent delivery member.

28. The method of claim 27 wherein the step of circumferentially rotating the distal end of the stent relative to the proximal end of the stent comprises rotating the elongated stent delivery member inner tubular member relative to the outer tubular member.

29. An anastomosis assembly for connecting a graft vessel between a first target vessel and a second target vessel, comprising

a) a first anastomotic stent for securing a first end of the graft vessel to the first target vessel, comprising

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- i) a substantially cylindrical body having a longitudinal axis, an open proximal end, an open distal end, and a lumen extending therein configured to receive the graft vessel; and
- 10 ii) at least one deformable section on the cylindrical body having a first configuration, and a radially-expanded second configuration which forms a flange configured to apply an expanding force radial to the cylindrical body longitudinal axis against the wall of the target vessel; and
- 15 b) a second anastomotic stent for securing a second end of the graft vessel to the second target vessel, comprising:
 - i) an outer flange configured to be positioned adjacent an outer surface of the second target vessel, having a body defining an opening configured to receive the second end of the graft vessel; and
 - ii) an inner flange connectable to the outer flange, having a body defining an opening, and being configured to be positioned adjacent an inner surface of the second target vessel, to provide fluid communication between a lumen of the graft vessel and a lumen of the second target vessel.